via communication means having a prescribed communication format, a method for controlling a plurality of portions in the information device, comprising:

providing selecting means to at least one of the plurality of control devices from the information device;

selecting one of the portions to be controlled using the selecting means;

transmitting information corresponding to the selected portion and identification information corresponding to the one control device to the information device;

preserving the identification information corresponding to the selected portion and the identification information corresponding to the one control device as a control correspondence table, wherein the information corresponding to the selected portion and the identification information correspond with each other;

repeating said selecting step, said transmitting step and said preserving step each time control devices selects a portion to be controlled

issuing a control request from another of the plurality of control devices to control another of the portions to be controlled, wherein the control request includes identification information corresponding to the another control device; and

controlling the another portion to be controlled by referring to the control correspondence table.

2. (Amended) The method according to claim 1, wherein the information device is connected to the plurality of control devices via an IEEE1394 digital interface.

3. (Amended) The method according to claim 1, wherein said selecting step includes providing a pass-through command defined in an AV/C panel subunit model and command set from the information device to the one control device and said step of controlling the one portion to be controlled includes

controlling using the pass-through command defined in the AV/C panel subunit model and the command set.

4. (Amended) The method according to claim 1, wherein the information device reproduces software information recorded in a digital versatile disc.

5. (Amended) The method according to claim 1, wherein the information device is connected to the plurality of control devices via an interface based on a wireless communication.

6. (Amended) The method according to claim 5, wherein the wireless communication uses the Bluetooth method.

7. (Amended) The method according to claim 5, wherein the wireless communication uses an infra-red ray method.

8. (Amended) The method according to claim 1, wherein the information device reproduces audio visual information recorded in a hard disc.

9. (Amended) The method according to claim 1, wherein each of the plurality of control devices is a digital television receiver capable of receiving digital broadcasts.

10. (Amended) An information processing apparatus connected to a plurality of control devices via communication means having a prescribed communication format to form a network, said information processing apparatus comprising:

a plurality of portions to be controlled, each of said plurality of portions being controllable by any one of the plurality of control devices;

a transmitter operable to provide selection means to each one of the plurality of control devices, for each control device, the selection means being operable to select one of said plurality of portions to be controlled by the control device;

a receiver operable to receive information corresponding to said selected portion and identification

information corresponding to the control device having selected said selected portion;

a preserving unit operable to preserve said information corresponding to selected said portion and said identification information as a control correspondence table, said information corresponding to said selected portion and said identification information corresponding with each other; and

a controller operable to control another of the portions to be controlled upon issuance of a control request from another of the plurality of control devices referring to said control correspondence table to determine which control device corresponds to the identification information of the another control device.

11. (Amended) An information control system, comprising:

an information device having a plurality of portions to be controlled;

a plurality of control devices, each said control device being capable of controlling each of said plurality of portions in said information device and having selection means for selecting one of said plurality of portions to be controlled and control request means for issuing a request to control the selected portion, said information device and said plurality of control devices being connected via communication means having a prescribed communication format to form a network;

a transmitter operable to provide the selection means to each one of said plurality of control devices;

a receiver operable to receive information corresponding to said selected portion and identification information corresponding to one of the plurality of control devices having selected said selected portion;

a preserving unit operable to preserve the information corresponding to said selected portion to be controlled and the identification information corresponding to the one control device as a control correspondence table, wherein the information and the identification information correspond with each other; and

a controller for controlling each of said selected portions by referring to the control correspondence table to determine which control device corresponds to the identification information.

INFORMATION CONTROL METHOD, INFORMATION PROCESSING APPARATUS, AND INFORMATION CONTROL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority from Japanese Application No. P2000-251238 filed August 22, 2000, the disclosure of which is hereby incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to an information control system in which, for example, an information device and a control device are connected via an interface to each other.

[0003] Conventionally, there exists an information control system in which an information device and a control device are connected via an interface to each other.

[0004] In this conventional information control system, the control device controlling the information device is called "a controller" and the information device being controlled by the control device is called "a target".

[0005] However, in the above-described conventional information control system, when the controller controls the target using a "pass-through" control command given to the target in a unified form, problems arise when the target has a plurality of subunits. Since the controller issuing the pass-through command cannot hold information on subunits in the target, when the pass-through command is issued to a target having a plurality of subunits, pass-through to the desired subunit cannot be controlled by the current pass-through command.

[0006] Moreover, in the above-described conventional information control system, additional problems arise when the target has a plurality of portions to be controlled (herein referred to as "controlled portions") and there are a

plurality of controllers. When a target having a plurality of controlled portions is controlled by a plurality of controllers, it is impossible to determine which one of the controlled portions in the target should be controlled by which controller. For this reason, this target is difficult to operate by the controller.

[0007] As described above, when it is unknown which one of the plurality of controllers issued the control command , the target having received that command has no way of determining how to process that command.

[0008] Thus, an object of the present invention is to provide an information control method, information processing apparatus, and information control system in which, even if there are a plurality of controlled portions in the information device and a plurality of control devices, the control devices can cause the information device to operate properly.

SUMMARY OF THE INVENTION

[0009] An information control method according to the present invention is applicable to an information device having a plurality of controlled portions connected to a plurality of control devices capable of controlling the information device via communication means having a predetermined communication format to form a network. The control device controls the controlled portions in the information device.

[0010] The information control method according to the present invention is as follows. The control device selects the controlled portion to be controlled from means for selecting the controlled portion which the information device provides to the control device. The selected information corresponding to the selected controlled portion and identification information corresponding to the control device selecting the controlled portion are transmitted to the

information device. The information device having received the selected information and the identification information corresponding to the control device causes therein the selected information corresponding to the selected controlled portion and identification information corresponding to the control device to correspond with each other and preserves both as a control correspondence table. Each time the control device selects the controlled portion, the selection, the transmission, and the preservation discussed above are repeatedly performed. When the information device receives a control request from the control device, the information device controls the controlled portion corresponding to the identification information of the issuance origin of the control request by referring to the control correspondence table.

[0011] An information processing apparatus according to the present invention is connected to a plurality of control devices via communication means having a prescribed communication format to form a network. The information processing apparatus is controlled by the plurality of control devices.

[0012] The information processing apparatus according to the present invention comprises a plurality of controlled portions to be controlled by the control devices; a transmitter for providing selection means to the control device in order that the control device can select a controlled portion to control; a receiver for receiving selected information corresponding to the controlled-portion selected by the selection means and identification information corresponding to the control device having selected the controlled portion; a preserving unit for preserving the identification information on the controlled-portion which is selected and the identification information on the control device as a control correspondence table in which the both are

in correspondence with each other; and a controller wherein, each time the control device selects the controlled portion the provision of the selection means, the reception made by the receiver, and the preservation made by the preserving unit are repeatedly performed, and when the receiver receives a control request from the control device the controller controls the controlled portion that corresponds to the identification information by referring to the control correspondence table.

[0013] An information control system according to the present invention is configured as follows. The control device includes selection means for selecting a controlled portion and a controller for making a request to control the selected controlled portion. The information device includes a plurality of controlled portions which are controllable by the control device; a transmitter for providing the selection means to the control device in order for the control device to select the controlled portion to control; a receiver for receiving selected information corresponding to the controlled portion selected by the selection means and identification information on the control device having selected the controlled portion; a preserving unit for preserving the selected information corresponding to the controlled portion selected and the identification information on the control device as a control correspondence table in which both correspond with each other; and a controller wherein, each time the control device selects the controlled-portion, the provision of the selection means, the reception of the receiver, and the preservation made by the preserving unit are repeatedly performed, and when the receiver has received a request to control from the control device, the controller controls the controlled-portion that corresponds to the identification information by referring to the control correspondence table that has been preserved.

[0014] Accordingly, the present invention has the following functions.

[0015] Since the information device and the control devices have information which is unique to the relevant device, unique "identification information" about one device can be acquired by other devices.

[0016] The control device acquires information on the controlled portion ("selected information") and, from identification information on the information device, selects an information device having the controlled portion which the user desires to control. Further, from the selected information corresponding to the controlled portion, the control device selects the controlled portion which the user wants to control.

[0017] Identification information corresponding to the control device that selected the controlled portion and selected information corresponding to the selected controlled portion are transmitted to the information device. The information device brings the selector identification information of the corresponding control device and the selected identification information to the controlled corresponding portion into correspondence with each other, and preserves both as a control correspondence table.

[0018] When thereafter a request to control a controlled portion is issued from the control device, the information device having received that request refers to the identification information on the control device having issued that request and the control correspondence table which it preserves therein. The information device, thereby controls the controlled portion as requested in the control request which is made to correspond thereto.

[0019] Thus, the control device controls the information device, or when selecting the controlled portion, the control

device interprets the operation made by the user and performs its control function via communication means.

[0020] The information device preserves the control correspondence table therein and so, when the control request to control a controlled portion is issued from the control device, the information device refers to the control correspondence table, to control the controlled portion.

[0021] This information control system is configured so that the information device can preserve the control correspondence table. Accordingly, by referring to the control correspondence table for the control requests from the plurality of control devices, the information device detects the controlled portion which is associated with the relevant control device, and it determines that the controlled portion detected is the one the control device desires to control and makes the controlled portion operated appropriately.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 is a configuration diagram showing an embodiment of a control system according to the present invention;

[0023] FIG. 2 is an explanatory diagram showing an embodiment of a data transmission cycle by an IEEE 1394 system bus;

[0024] FIG. 3 is an explanatory diagram showing an embodiment of the address space in the CSR architecture;

[0025] FIG. 4 is an explanatory diagram showing embodiments of position, name, and function of the principal CSR;

[0026] FIG. 5 is an explanatory diagram showing an embodiment of the general ROM format;

[0027] FIG. 6 is an explanatory diagram showing embodiments of the bus info block, root directory, and unit directory;

[0028] FIG. 7 is an explanatory diagram showing an embodiment of the PCR;

[0029] FIGS. 8A to FIG. 8B are explanatory diagrams each showing an embodiment of oMPR, oPCR, iMPR, and iPCR;

[0030] FIG. 9 is an explanatory diagram showing an embodiment of the relation among the plug, plug control register, and transmission channel;

[0031] FIG. 10 is an explanatory diagram showing an embodiment of a data structure according to a hierarchical structure of a descriptor;

[0032] FIG. 11 is an explanatory diagram showing an embodiment of the data format of the descriptor;

[0033] FIG. 12 is an explanatory diagram showing an embodiment of the generation ID in FIG. 11;

[0034] FIG. 13 is an explanatory diagram showing an embodiment of the list ID in FIG. 11;

[0035] FIG. 14 is an explanatory diagram showing an embodiment of a stack model of the AV/C command;

[0036] FIG. 15 is an explanatory diagram showing the relation between the command and response of FCP;

[0037] FIG. 16 is an explanatory diagram showing the relation between the command and response in FIG. 15 in more detail;

[0038] FIG. 17 is an explanatory diagram showing an embodiment of the data structure of the AV/C command;

[0039] FIG. 18 is an explanatory diagram showing a specific embodiment of the AV/C command;

[0040] FIG. 19 is an explanatory diagram showing a specific embodiment of the command and response of the AV/C command;

[0041] FIG. 20 is a structure diagram showing an embodiment of the information device notification means according to the present invention;

[0042] FIG. 21 is a structure diagram showing an embodiment of the controlled-portion notification means according to the present invention;

[0043] FIG. 22 is a structure diagram showing an embodiment of the remote controller according to the present invention;

[0044] FIG. 23 is a structure diagram showing an embodiment of the control correspondence table according to the present invention;

[0045] FIG. 24 is a diagram showing an embodiment of the control flow; and

[0046] FIG. 25 is a diagram showing a format of the pass-through command.

DETAILED DESCRIPTION

[0047] An information control method according to one embodiment of the invention enables one desired portion in a network which is formed by connecting an information device having a plurality of controlled portions with a control device for controlling the information device via communication means to be controlled. The method is applicable even if the controller for controlling the controlled portion (e.g., a control command for the controlled portion, etc.) does not have identification information regarding the final destination of the controlled portion (e.g., ID (identification information) of the controlled portion, etc.).

[0048] The information control system includes an information device having a plurality of portions to be controlled or "controlled portions", an interface for connecting the information device to a control device, and a plurality of control devices each of which belongs to its relevant user.

[0049] In this information control system, the information device and the control device are connected with each other via communication means capable of bi-directional transmission of information to thereby form a network. Various types of information such as data or control signals are transmitted or received through this network.

[0050] In this information control system, it is arranged that, when the control device makes the control request after the controlled portion of the information device has been selected via the controller, the system is fully equipped with such a structure that enables it to control the selected controlled portion.

[0051] The information device and each of the control devices are equipped with a device unique information memory that retains information unique to the respective devices. An example of this device unique information memory is a configuration ROM which is prescribed in P1212, Draft Standard for a Control and Status Registers (CSR) Architecture for microcomputer buses, a standard communication format. In this device unique information memory, it is arranged that the following three information items are retained. Firstly, a vendor name that is information on a vendor indicating a name of the maker which has manufactured the information device, secondly a model name or information on a model of the information device, and thirdly, information for identifying the device, such as an icon that is image information on the information device.

[0052] For example, according to an IEEE 1394 format, information unique to the device is stored in the configuration ROM (Read Only Memory) of the device.

[0053] Moreover, the information device and each control device is equipped with device unique information acquirement means for acquiring the device unique information from the device unique information memory as described above. An example of this device unique information acquirement means is an asynchronous read request. P1394 Standard for a High Performance Serial Bus is a standard for communication format.

[0054] Furthermore, the information device and the control devices are equipped with means for acquiring information on

the devices at the time of initializing the network connected using this device unique information acquirement means.

[0055] This allows, at the time of initializing the network, every connected node to acquire information on any connected device by reading the configuration ROM.

[0056] Moreover, the control device is equipped with an information device notification unit which notifies a user who wants to control the controlled-portion of information obtained by the device unique information acquirement means. A Graphical User Interface (GUI) is an example of an information device notification unit.

[0057] Furthermore, the control device is equipped with information device selection means for selecting the information device having a controlled portion which the user wants to control from the information on the information device given by the information device notification unit.

[0058] This allows the control device to select an icon on a monitor through the GUI using a remote commander. The control device can thereby select the information device having a controlled portion which the user wants to control.

[0059] In addition, the information device includes a controlled-portion notification unit for notifying the control device of information on the controlled-portion via communication means. An example of the controlled portion notification unit is a panel prescribed in AV/C command (AV/C Panel Subunit Model and Command Set).

[0060] This enables the information device to provide information for acquiring information on the controlled portion.

[0061] For example, in a case where the interface is based on the IEEE 1394 format and the device is controllable using the AV/C command, the device has information regarding the "subunit type" or controlled portion which indicates the function of the device.

[0062] In this connection, a word "unit" means a digital device itself, while the word "subunit" means what takes charge of functions of the digital device. Accordingly, a combination of the subunits forms a unit. It is suitably determined by what function the interior of the unit is divided.

[0063] For example, regarding digital devices, a digital television (DTV) unit comprises a combination of a tuner subunit (receiving function) and monitor subunits. Also, a television-integrated video tape recorder unit has a combination of a tuner subunit (receiving function), a monitor subunit, and a tape recorder/player subunit (recording function/playback function). Also, for a hard disc (HDD) unit, a combination of a hard disk recorder/player subunits (recording/playback function) is considered. Also, for a digital versatile disc (DVD) unit, a combination of a digital versatile disc recorder/player subunit (recording function/playback function) is considered. In this manner, suitable subunits are functional units.

[0064] It is noted that the above-mentioned subunits are imaginary functional units and therefore do not always coincide with actual circuit structures. It is also noted that some circuits fall outside the category of any subunits, such as a decoder block which is not needed to be controlled by the AV/C command.

[0065] In addition, the information device and the control devices are equipped with a controlled portion transmission selection means as follows. When selecting the controlled portion based on information supplied by the controlled portion notification unit, the control device transmits the user's selected operation information as a control request to the information device via the communication means. The information device having received the control request interprets it according to what kind of operation has been

performed to realize the selection of the controlled portion. The information device and the control devices have controlled portion transmission selection means for realizing the selection of the controlled-portion. Thereafter, the information device updates the controlled-portion notification unit in response to the user's operation. An example of the controlled-portion transmission selection means is a pass-through command, which is prescribed in the AV/C commands (AV/C Panel Subunit Model and Command Set).

[0066] Also, it is assumed that, when the control device transmits a control request given by the user to the information device as a request to control via the communication means, the information device that has received the control request controls the controlled portion. Thus, the information device and the control devices have a controlled portion transmission controller. An example of the controlled portion transmission controller is the pass-through command which is prescribed in the AV/C command (AV/C Panel Subunit Model and Command Set). This pass-through command is given in a unified form to the information device having a plurality of controlled-portions.

[0067] Furthermore, the control device has a structure that, when the controlled-portion transmission selection means or the controlled-portion transmission controller is executed, the identification information of the control device (hereinafter referred to as "identification information") or control request is transmitted via the communication means. An example of the identification information is a source ID which is indicated by two consecutive bits as counted from the 33rd bit contained in the 1394 packet header of an asynchronous packet.

[0068] In addition, the information device is assumed to be equipped with a preserving unit that can preserve the two kinds of identification information in a corresponding

relationship to each other. One is the identification information on the selected controlled portion (hereinafter referred to as "the selected information") which the information device can acquire by means of the controlled-portion transmission selection means. The other is the selector/identification information which the information device receives from the control device. The correspondence relationship between the information is preserved and is hereinafter called "the control correspondence table".

[0069] Moreover, when receiving the controlled-portion transmission control means from the control device the information device, has a controller that controls the controlled-portion that corresponds to the issuer of the controlled-portion transmission control means by referring to the control correspondence table.

[0070] Furthermore, the control device has a structure that can provide information device selection means to the user at any time.

[0071] Also, the information device and the control devices have such structure that, when selecting the information device by the information device selection means, the selected information is transmitted to the information device, a call is made of the controlled-portion notification means.

[0072] Because the information device and the control devices each have the above-mentioned structures, the information control system is particularly advantageous since a single controlled portion can be controlled even if there are a plurality of controlled portions and a plurality of information devices and there is no information on a final destination of the controlled portion.

[0073] As described above, the information control system can preserve the control correspondence table. As a result of this, the information device can refer to the control correspondence table on receipt of the control requests from a

plurality of control devices. Therefore, the information apparatus can detect the controlled portion which is associated with the control device and decide that the detected controlled portion is the portion which the control device desires to control. The information device can thus make that controlled-portion operate properly.

[0074] The information control system configured in this way operates as follows.

[0075] When the information device and a plurality of control devices are connected via communication means to form a network and the network is initialized, each of the devices acquires information on the other devices forming the network using the device unique information acquirement unit.

[0076] When the user controls the information device through the control device, the user calls the information device notification unit uses the information device selection means, and selects the information device which the user desires to control.

[0077] On this occasion, the controlled-portion notification unit is called. The user uses the controlled-portion transmission selection means to select the controlled-portion which the user wants to control.

[0078] Simultaneously with this, the controlled-portion transmission selection means is executed, so that, the selector identification information is supplied to the information device. Simultaneously with this, the controlled-portion transmission selection means is executed, so that, the information device acquires the selected controlled portion identification information. Simultaneously with this, the information device makes the selector identification information and the selected portion identification information correspond to each other. Then, the information device preserves both the selected information and the

identification information as the control correspondence table.

[0079] Thereafter, when the request to control the controlled portion is issued through the control device by the controlled portion transmission controller, the information device having received the control request refers to the identification information on the device having issued that controlled-portion transmission control means and the control correspondence table. Then, the information device gives an effect of the controlled-portion transmission controller on the portion that has been found as having the correspondence.

[0080] FIG. 1 is a diagram illustrating the configuration of the information control system according to the present invention.

[0081] The information control system includes a first control device or "DTV1" 10 having an IEEE 1394 interface 12, a second control device or "DTV2" 20, and an information device or "DVD player" 1 having an IEEE 1394 interface 9. The information control system uses an IEEE 1394 interface method as communication means 18 and 19. Additionally, although not illustrated, the second control device 20 has the same structure as that of the first control device 10 which will be described below.

[0082] Here, an explanation will be given of the IEEE1394 interface which is utilized in the present information control system.

[0083] FIG. 2 is a diagram illustrating a cycle structure of data transmission between the devices connected by means of the IEEE1394 type bus. In the IEEE1394, the data is divided into packets and it is time-divisionally transmitted on a basis of 125 μs length cycle. This cycle is produced by a cycle start signal supplied from a node (any one of the devices connected to the bus) which has a cycle master function. An isochronous packet secures a band which is

necessary for its transmission and that is measured from the head of every cycle (it is called a "band" although it is a unit of time length). Therefore, in the isochronous transmission, the transmission of data within a fixed length of time is guaranteed. In case a transmission error occurs, however, data is lost since there is no protection. In an asynchronous transmission which is performed during a time length of each mechanism cycle not used for the isochronous transmission and in which the node having ensured therefor the bus as a result of arbitration sends out an asynchronous packet, it is possible to execute an acknowledge/retry process, so that reliable transmission guaranteed. However, transmission timings are not definite.

[0084] For a prescribed node to perform isochronous transmission, the node must be compatible with the isochronous function. In addition, at least one of the nodes compatible with the isochronous function must have a cycle master function. Further, at least one of the nodes connected to the IEEE1394 serial bus 9-1 to 9-4 must have an isochronous resource manager function.

[0085] IEEE1394 is based on a CSR (Control and Status Register) architecture which has a 64 bit address space prescribed in ISO/IEC13213. FIG. 3 is a diagram illustrating the structure of the address space of the CSR architecture. The upper 16 bits are node IDs which represent nodes on the respective IEEE1394s. The remaining 48 bits are used for designating the address space which is given to the respective nodes. The upper-order 16 bits are further classified into 10 bits for bus ID's and 6 bits for physical ID's (the node ID's in a narrow sense). Because a value in which every bit is "1" is used for special purposes, the upper 16 bits can designate 1023 pieces of bus and 63 pieces of node.

[0086] The space defined by upper 20 bits out of the 256-address space defined by the lower 48 bits is divided into an

initial register space (Initial Register Space) used for peculiar 2046-byte register, for CSR- peculiar IEEE1394 register and the like, a private space, an initial memory space and so on. The space defined by the lower 28 bits, in case the space defined by the upper 20 bits thereof is the initial register space, is used as a configuration ROM (Read Only Memory), an initial unit space used for peculiar applications, a plug control register (PCRs), and so on.

[0087] FIG. 4 is a diagram illustrating offset addresses, names, and functions of principal CSRs. The "offset" in FIG. 4 represents the offset addresses from the address "FFFFF0000000h (the numeral with "h" at its end represents hexadecimal rotation) at which the initial register space begins. The bandwidth available register having the offset address 220h represents bands which can be assigned to the isochronous communication where only a value of the node operating as the isochronous resource manager is effective. While each node has the CSR of FIG. 3, as regards the bandwidth available register, only the isochronous resource manager has is handled being an effective. In other words, the bandwidth available register is substantially possessed by the isochronous resource manager only. In the bandwidth available register there is preserved a maximum value in case no bands is assigned to the isochronous communication. Each time any band is assigned thereto, the value decreases.

[0088] As for the channels available register corresponding to the offset addresses 224h to 228h, each bit thereof corresponds to each of channel numbers from #0 to #63. In case the bit has a value of "0", it indicates that the relevant channel has already been assigned. Only the channels available register of the node operating as the isochronous resource manager is effective.

[0089] Referring back to FIG. 3, in the addresses 200h to 400h within the initial register space, there is assigned a

configuration ROM based on a general ROM (Read Only Memory) format. FIG. 5 is a diagram illustrating the general ROM format. The node which is a unit of access on the IEEE1394 can have therein a plurality of units each of which independently operates while commonly using the address space. Unit directories can indicate the version and position of software for in that unit. Although the positions of bus info block and root directory are made fixed, the positions of the other blocks are designated by the offset addresses.

[0090] FIG. 6 is a diagram illustrating the details of the bus info block, root directory, and unit directory. A "Company ID" inside the bus info block stores an ID number which indicates the manufacturer of device. A "Chip ID" stores a world-unique ID which is unique to the device without overlapping those of the other devices. According to the IEC 61833 standard, in a unit directory of the apparatus that satisfies the IEC61883, at the first octet, second octet, and third octet of a "unit spec ID" thereof are written 00h, Aoh, and 2Dh, respectively. Further, in a unit switch version (unit sw version), at the first octet thereof and at the LSB (Least Significant Bit) of the third octet thereof are written 01h and 1, respectively.

[0091] In order to control the input/output of the device via the interface, the node has a PCR (Plug Control Register) prescribed under the IEC61883 in the addresses 900h to 9FFh within the initial unit space of FIG. 3. This is concept of a "plug" substantiated in order to form a signal path which has logical similarity to the analog interface. FIG. 7 is a diagram illustrating the construction of the PCR. The PCR has an oPCR (output Plug Control Register) which represents an output plug and an iPCR (input Plug Control Register) which represents an input plug. Also, the PCR has a register oMPR (output Master Plug Register) indicating the information on the output plug unique to each apparatus and a register iMPR

(input Master Plug Register) indicating the information on the input plug unique to each device. Although each device has the possibility of having neither a plurality of oMPR nor a plurality of iMPR, it can have a plurality of oPCRs and iPCRs corresponding to its individual plugs according to its capability. The PCR illustrated in FIG. 7 has 31 pieces of oPCR's and 31 pieces of iPCR's. The flow of the isochronous data is controlled by operating the registers corresponding to these plugs.

[0092] FIGS. 8A to 8D are diagrams illustrating the constructions of oMPR, oPCR, iMPR, and iPCR. FIG. 8A illustrates the construction of an oMPR; FIG. 8B illustrates the construction of oPCR; FIG. 8C illustrates the construction of an iMPR; and FIG. 8D illustrates the construction of an iPCR. In a 2 bit area of "data rate capability" on the MSB side in each of the oMPR and iMPR stores a code which representing a maximum transmission rate for the isochronous data that the relevant device can transmit or receive. The "broadcast channel base" in the oMPR prescribes a number of a channel which is used for the broadcast output.

[0093] A 5 bit area of "number of output plugs" on the LSB side of the oMPR stores a value which represents the number of the output plugs possessed by the relevant device has, i.e., the number of oPCRs. A 5 bit area of "number of input plugs" on the LSB side of the iMPR stores the number of the input plugs the relevant device, i.e. the number of iPCRs. Areas of "non-persistent extension field" and "persistent extension field" are for future extension.

[0094] An area of the MSB "on-line" in each of the oPCR and iPCR represents the state of use of the plug. To be specific, a value of 1 indicates that the relevant plug is ON-LINE. A value of 0 indicates that the plug is OFF-LINE. A value of "broadcast connection counter (broadcast connection counter)" in each of the oPCR and iPCR represents the presence (1) or

absence (0) of the broadcast connection. A value of "point-to-point connection counter" having a with 6 bit width in each of the oPCR and iPCR has represents the number of the point-to-point connections possessed by the relevant plug has.

[0095] A value of "channel number having a 6 bit width" in each of the oPCR and iPCR represents a number of a isochronous channel to which the relevant plug is connected. A value of "data rate" having a 2 bit width in the oPCR represents the real transmission rate of the packet of the isochronous data outputted from that plug. A code which is stored in "overhead ID" having a 4 bit width in the oPCR represents an over bandwidth of the isochronous communication. A value of "payload " having a 10 bit width in the oPCR represents the maximum value of data contained in the isochronous packet which can be handled by the relevant plug.

[0096] FIG. 9 is a diagram illustrating the relationship among the plug, plug control register, and isochronous channel. AV devices 91 to 93 are connected to each other through the use of the IEEE1394 serial bus. Of the oPCR [0] to oPCR [2] of which transmission rate and the number of oPCR are determined by the oMPR of the AV device 93, isochronous data whose channel is designated by the oPCR [1] is sent out to a channel #1 of the IEEE1394 serial bus. Of the iPCR [0] and iPCR [1] whose transmission rate and the number of iPCR are determined by the iMPR of the AV devices 91, the AV device 91 reads in the isochronous data sent out into the channel #1 of the IEEE1394 serial bus by the iPCR [0] having the transmission rate of the input channel #1. Similarly, the AV device 92 sends out the isochronous data a channel #2 designated by the oPCR [0]. The AV device 91 reads in that isochronous data from the channel #2 designated by the iPCR [1].

[0097] In this way, data transmission is performed among the devices which are connected to each other through the

IEEE1394 serial bus. In the system of this embodiment is utilized the AV/C command set which is prescribed as commands for controlling the apparatuses connected to each other via the IEEE1394 serial bus. The system is arranged to control each device, or estimate the status of each device using AV/C command set. Next, a description will be given of this AV/C command set.

[0098] First, the data structure of the Subunit Identifier Descriptor in the AV/C command set used in the system of this embodiment will be described with reference to Figs. 10 to 13. FIG. 10 illustrates the data structure of the Subunit Identifier Descriptor. The subunit identifier Descriptor is formed by lists of a hierarchical structure as illustrated in FIG. 10. The list represents, for example, a channel capable of receiving if the relevant item is a tuner, and represents a music, etc. recorded in a disc if the relevant item is a disc. The lists in the uppermost-order layer of the hierarchical structure are called "the root lists". For example, the list 0 forms a root list for its lower lists. The list 2 to list (n-1) also form root lists. There are as many root lists as the number of objects. The objects are the channels in the digital broadcast when the AV device is a tuner. All the lists in one layer of the hierarchy share common information.

[0099] FIG. 11 illustrates the format of a General Subunit Identifier Descriptor which is used in existing systems. A Subunit Identifier Descriptor 41 has attribute information on functions described in contents. It does not include a value of a descriptor length field itself. A generation ID represents a version of an AV/C command set. As illustrated in FIG. 12, its value is at present "00h" ("h" expresses the hexadecimal representation). This "00h" means that data structures and command sets are version 3.0 of the AV/C General Specification. Also, as illustrated in FIG. 12, all

other values than the value "00h" are reserved for future specification.

[0100] A size of list ID represents the number of bytes in a list ID. A size of object ID represents the number of bytes in an object ID. A size of object position represents the position in the list (the number of bytes) which is used in case referred to when performing the control. A number of root object lists represents the number of root object lists. A root object list id represents an ID for identifying the uppermost root object lists in the respective independent hierarchies.

[0101] A subunit dependent length represents the number of bytes in the succeeding subunit dependent information field. The subunit dependent information is a field which indicates information peculiar to the relevant function. A manufacturer dependent length indicates the number of bytes in the succeeding manufacturer dependent information field. The manufacturer dependent information is a field which indicates specification information on the relevant vendor (maker). It is noted that when the descriptor has no manufacturer dependent information, this field does not exist.

[0102] FIG. 13 illustrates the assignment ranges of the list IDs illustrated in FIG. 11. As illustrated in FIG. 13, the ranges "0000h to 0FFFh" and "4000h to FFFFh" each are reserved as the assignment ranges for future specification. "1000h to 3FFFh" and "10000h to max list ID value" are prepared for identifying dependent information on the subunit type.

[0103] Next, the AV/C command set used in the system of this embodiment will be described with reference to Figs. 14 to 19. FIG. 14 illustrates a stack model of the AV/C command set. As illustrated in FIG. 14, a physical layer 81, link layer 82, transaction layer 83, and serial bus management 84 are based on the IEEE1394. An FCP (Function Control Protocol)

85 is based on the IEC61883. An AV/C command set 86 is based on the 1394TA spec.

[0104] FIG. 15 is a diagram illustrating the command and response of the FCP85 in FIG. 14. The FCP is a protocol for controlling the AV apparatus under the IEEE1394. As illustrated in FIG. 15, the controlling side is a controller while the controlled side is a target. The transmission of a FCP command or the response thereto is performed between the nodes using a write transaction during the asynchronous communication under the IEEE1394 standard. The target which receives data returns an acknowledge (ACK) signal to the controller for confirmation of that reception.

[0105] FIG. 16 is a diagram illustrating in more detail the relationship between the command and response of FCP illustrated in FIG. 15. A node A and a node B are connected to each other via the IEEE1394 bus. The node A is the controller and the node B is the target. Both node A and B have a command register and a response register have 512 bytes respectively. As illustrated in FIG. 16, the controller writes a command message into the command register 93 of the target and thereby transmits a relevant command. Also, conversely, the target writes a response message into the response register 92 of the controller and it thereby transmits a relevant response. For these two messages, exchange of control information is performed. The kind of the command set which is sent by the FCP are described in an area "CTS" in the data field of FIG. 17 as later described below.

[0106] FIG. 17 illustrates the data structure of the packets which are transmitted in the asynchronous transmission mode of the AV/C command. The AV/C command set is the one for controlling the AV device in which CTS (the command set ID) = "0000". The AV/C command frame and response frame are transmitted/received between the nodes through the use of the FCP. In order to cause no burden on the bus and AV device, it

is designed that the response to the command is made within a time length of 100 ms. As illustrated in FIG. 17, the data of the asynchronous packet is comprised of 32 bits (=1 quadlet) in the horizontal direction. The upper stage in the figure represents a header part, while the lower stage thereof represents a data block. An area "destination_ID" indicates the relevant destination.

[0107] The "CTS" represents the ID of the command set. In case of the AV/C command set, the CTS = "0000". When the packet is a command, a "ctype/response" field indicates the functional classification of that command. When the packet is a response, the "ctype/response" field indicates the processed results of the relevant command. The commands are roughly classified into the following four kinds of definitions. (1) commands for controlling the functions from the outside (CONTROL), (2) commands for inquiring about the relevant status from the outside (STATUS), (3) commands for inquiring from the outside about the presence or absence of supporting the relevant control command (GENERAL INQUIRY (the presence or absence of the for-use-for-support opcode)) and (SPECIFIC INQUIRY (the presence or absence of supporting opcode and operands)), and (4) commands for requesting to notify a change in the status to be notified to the outside (NOTIFY).

[0108] A response is returned according to the kind of command. The response to the "CONTROL" command includes "NOT IMPLEMENTED", "ACCEPTED", "REJECTED", and "INTERIM". The response to the "STATUS" command includes "NOT IMPLEMENTED","REJECTED", "IN TRANSITION", or "STABLE". The response to the "GENERAL INQUIRY" / "SPECIFIC INQUIRY" commands is "IMPLEMENTED" and "NOT IMPLEMENTED". The response to the "NOTIFY" command includes "NOT IMPLEMENTED", "REJECTED, "INTERIM", and "CHANGED".

[0109] A "subunit type" area is provided for specifying the functions within the device and, for example, a tape

recorder/player, a tuner, etc area assigned therein. To distinguish between the subunits if there are a plurality of subunits of the same kind, addressing is performed using the subunit ids as identification numbers. The "opcode" represents commands while the "operand" represents the parameters of each command. "Additional operands" is a field which is added if necessary. A field "padding" is also what is added if necessary. A field "data CRC (Cyclic Redundancy Check)" is used for error check in data transmission.

[0110] FIGS. 18A to 18C illustrate specific examples of the AV/C commands. FIG. 18A illustrates specific examples of the "ctype/response" field. The upper stage in the figure represents commands while the lower stage therein represents responses. "0000" is assigned the command "CONTROL"; "0001" is assigned the command "STATUS"; "0010" is assigned the command "SPECIFIC INQUIRY"; "0011" is assigned the command "NOTIFY"; "0100" is assigned the command "GENERAL INQUIRY"; and "0101" to "0111" are reserved for future specification. Also, "1000" is assigned the response "NOT IMPLEMENTED"; "1001" is assigned the response "ACCEPTED"; "1010" is assigned the response "REJECTED"; "1011" is assigned the response "IN TRANSITION"; "1101 the response "CHANGED"; "1100" the response "IMPLEMENTED/STABLE"; "1111" is assigned the response "INTERIM"; and "1110" is reserved for future specification.

[0111] FIG. 18B illustrates specific examples of the subunit type. "00000", "00011", "00100", "00101", "00111", "11100", and "11110" are assigned "Video Monitor", "Disc recorder/Player", "Tape recorder/Player", "Tuner", "Video Camera", "Vendor unique", and "Subunit type extended to next byte", respectively. Additionally, while "unit" is assigned "11111", it is used in the case of sending to the apparatus itself, such as turning the power "on" or "off".

[0112] FIG. 18C illustrates specific examples of the opcode commands. For each subunit type there exists an opcode table.

Herein, there is illustrated the opcode table when the subunit type is "Tape recorder/Player". For each opcde, operand is defined. In the op codes "00h", "50h", "51h", "52h", "60h", "61h", "62h", "C1h", "C2h", "C3h", and "C4h" are herein assigned the operands "VENDOR-DEPENDENT", "SEARCH MODE", "TIMECODE", "ATN", "OPEN MIC", "READ MIC", "WRITE MIC", "LOAD MEDIUM", "RECORD", "PLAY", AND "WIND", respectively.

[0113] FIGS. 19A to 19B illustrate specific examples of the AV/C command and the response thereto. For example, when instructing a playing device as a target (consumer) on playback, the controller sends a command such as shown in FIG. 19A to the target. This command is CTS "0000" because of using the AV/C command set. Because the command (CONTROL) for controlling the device from the outside is used, ctype = "0000" (see FIG. 18A). Because the subunit type is "Tape recorder/Player", it is pre-determined that "subunit type" = "00100" (see FIG. 18B). As the "id" represents a case where it is ID0 and therefore id = 000. The "opcode" is "C3h which means the reproduction (see FIG. 18C). The "operand" is "75h" which means "FORWARD". When played back, the target returns a response such as that shown in FIG. 19B to the controller. Because the response is herein "accepted" which means the acceptance, response = "1001" (see FIG. 18A). Except for the "response", others are the same as those in FIG. 19A. Therefore, the description will be omitted.

[0114] Referring to FIG. 1 again, it is assumed that the first control device 10, second control device 20, and information device 1 each have an asynchronous read request as the device-unique information acquirement means.

[0115] Also, it is assumed that the first control device 10 is equipped, as the information device notification unit, with a GUI as illustrated in FIG. 20 (hereinafter referred to as "a device GUI"). As shown in FIG. 20, company A DTV1 21, company

A DVD Player 22, company B DVD Player 23, and company B DTV2 24 are connected via a network 25.

[0116] Also, the information device 1 is equipped with a GUI as illustrated in FIG. 20 (hereinafter referred to as "a controlled-portion GUI"). As shown in FIG. 20, a company A DVD Player 31 contains a DVD Disc1 32 and a DVD Disc2 33.

[0117] When the company A DVD Player 22 is selected using a remote controller 41 (FIG. 22), the company A DVD Player 31 has, as its subordinate sub-units, the DVD Disc1 32 and the DVD Disc2 33.

[0118] The remote controller 41 (FIG. 22) has control buttons 42 including a playback button 43, buttons for stop, fast forwarding, rewinding, and the like. It also has a selected object execution button 48 for executing an item selected by means of an upper button 44, lower button 45, right button 46, and left button 47. Further, it has an information device notification unit display button 49 as described below.

[0119] Also, it is assumed that the first control device (DTV1) 10 includes a display 15 (FIG. 1) which is a device for displaying the GUI serving as the information device notification unit and controlled-portion notification unit.

[0120] Moreover, the controlled-portion GUI possessed by the information device 1 is displayed as follows. A device is selected on the device GUI, and the selected information is transmitted to the information device 1. Then, the information device 1 produces data on the controlled-portion GUI, and transmits the data to the first control device 10. Thus, the controlled-portion GUI is displayed on the display 15 of the first control device 10.

[0121] The first control device 10 is equipped with a user's operation converting section 16 comprising a controlled-portion transmission selector and controlled-portion transmission controller. The user's operation

converting section 16 receives information on the user's operation of the remote controller 17, interprets that operation and converts it into a pass-through command. The user's operation converting section 16 then issues the pass-through command from the interface 12.

[0122] Furthermore, the user's operation converting section 16 is arranged to have another function of displaying the device GUI when it receives a signal generated by the operation of the information device notification unit display button 49 of the remote controller 41 shown in FIG. 22.

[0123] In addition, the user's operation converting section 16 is arranged to have another function of updating the device GUI. Specifically, when the device GUI is displayed, if the section 16 receives the information resulting from the user's operation of the remote controller 17, it interprets that operation and updates the device GUI, rather than interpreting that user's operation and converting it into the pass-through command.

[0124] Moreover, the user's operation converting section 16 is arranged to have the following function. When a device GUI is displayed and a device has been selected, if the section 16 has received a signal resulting from the operation of the selected object execution button 48 of the remote controller 41 in FIG. 22, it transmits a request to display the controlled-portion GUI (hereinafter referred to as "the controlled-portion GUI display request") to the information device 1 via the interface 12.

[0125] Furthermore, the information device 1 is arranged to have the following function. When having received the controlled-portion GUI display request from the first control device 10, the information device 1 transmits data on the controlled-portion GUI to the first control device 10.

[0126] In addition, the first control device 10 includes a CPU2 11 for performing the control of that display, a ROM2 14

for storing a control program therefor, and a RAM2 13 for a working area for making a display on the display 15 when receiving the data on the controlled-portion GUI.

[0127] Also, the information device 1 has a RAM1 5 storing a control correspondence table 51 (FIG. 23) as the control correspondence table. In FIG. 23, the control correspondence table 51 shows that a DVD Disc1 53 corresponds to a company A DTV1 52 and a DVD Disc2 55 corresponds to a company A DTV2 54.

[0128] Moreover, the information device 1 includes a DVD playback deck 3 capable of reproducing a DVD software 4 in which information on controlled-portion 1 is recorded and a DVD playback deck 7 capable of reproducing DVD software 8 in which information on controlled-portion 2 is recorded.

[0129] Furthermore, the information device 1 includes the following elements so that, when having received a pass-through command, the device can effect the command on the controlled-portion corresponding to the issuer of the command by referring to the control correspondence table 51. A CPU1 2 for performing the control for that purpose, a ROM1 6 storing a control program therefor, and a RAM1 5 for a work area.

[0130] The operation will be described below.

[0131] A control flow therefor is illustrated in FIG. 24.

[0132] The control device 61 and the information device 62 are connected first with each other via communication means in accordance with the IEEE 1394 communication format to form a network. In this case, the information device 62 is a DVD player, and the control device 61 includes a DTV1 10 and a DTV2 20.

[0133] The control device 61 issues the asynchronous read request C1 to the information device 62 and the information device 62 issues the asynchronous read request C2 to the control device 61. At a time point T1, the control device 61, acquires the device-unique information on the information device 62 connected to the network and retains the acquired

information in the RAM2 13 illustrated in FIG. 1. At a time point T11, the information device 62, acquires the device-unique information on the control device 61 connected to the network and retains the acquired information in the RAM1 5 illustrated in FIG. 1.

[0134] When the user controls the DVD player 1 of the information device 62 via the DTV1 10 of the control device 61, the following operation is performed. When, in the DTV1 10 of the control device 61, the information device notification unit display button 49 of the remote controller 41 (FIG. 22) is operated, the resulting signal is transmitted to the user's operation converting section 16 of the DTV1 10 of FIG. 1. The resulting signal is interpreted in the user's operation converting section 16 and at a time point T2, the device GUI is displayed on the display 15.

[0135] In the DTV1 10 of the control device 61, the operation of the upper button 44, lower button 45, right button 46, and left button 47 of the remote controller 41 (FIG. 22) selects the DVD player 1 of the information device 62 displayed on the device GUI and the following operation is performed. For each said selection, the resulting signal is transmitted to the user's operation converting section 16 of the DTV1 10 (FIG. 1). The resulting signal is interpreted in the user's operation converting section 16. Then, the device GUI on the display 15 is updated.

[0136] Next, when in the DTV1 10 of the control device 61, the selected object execution button 48 of the remote controller 41 (FIG. 22) is operated in a state where the DVD player 1 of the information device 62 is selected, at a time point T3, the resulting signal is transmitted to the user's operation converting section 16 of the DTV1 10 (FIG. 1). The resulting signal is interpreted in the user's operation converting section 16. Then, the controlled-portion GUI

display request C3 is transmitted to the DVD player 1 of the information device 62 via the interface 12.

[0137] At a time point T12, the DVD player 1 of the information device 62 which has received the controlled-portion GUI display request C3 prepares controlled-portion GUI data C4. It then transmits the controlled-portion GUI data C4 to the DTV1 10 of the control device 61 via the interface 9.

[0138] At a time point T4, the DTV1 10 of the control device 61 based on the controlled-portion GUI data C4 received, makes a GUI display, at a point in time T4, of the GUI data of the controlled-portion on the display 15.

[0139] When, in the DTV1 10 of the control device 61, at a time point T5, the user performs his selecting operation using the upper button 44, lower button 45, right button 46, and left button 47 on the remote controller 41 (FIG. 4) and the DVD Disc1 53 of the information device 62 displayed on the controlled-portion GUI is selected, the resulting signal is transmitted to the user's operation converting section 16 of the DTV1 10 (FIG. 1). The resulting signal is interpreted in the user's operation converting section 16. Then, the pass-through command C5 corresponding to the resulting signal is issued to the DVD player 1 of the information device 62.

[0140] In response thereto, at a time point T13, the DVD player 1 of the information device 62 prepares the controlled-portion GUI data C6. The DVD player 1 then transmits the controlled-portion GUI data C6 to the DTV1 10 of the control device 61 via the interface 9.

[0141] At a time point T6, the DTV1 10 of the control device 61 updates the controlled-portion GUI on the display 15.

[0142] When, in the DTV1 10 of the control device 61, the user operates the selected object execution button 48 of the remote controller 41 (FIG. 22), in a state where the DVD Disc1 displayed on the controlled-portion GUI is selected at a point

T7. Then, through this user's operation, the resulting signal is transmitted to the user's operation converting section 16 of the DTV1 10 (FIG. 1). The resulting signal is interpreted in the user's operation converting section 16. Then, the pass-through command C7 corresponding to the resulting signal is issued to the DVD player 1 of the information device 62.

[0143] On this occasion, not only is the selected information indicating that the selection has been made transmitted to the DVD player 1 of the information device 62 via the interface 12, but also the identification information on the control device itself having made that selection of the company A DTV1 52 is also transmitted in such a form as affixed to the pass-through command C7.

[0144] At a time point T14, the DVD player 1 of the information device 62 having received the pass-through command C7, preserves the identification information on the control device itself having selected the company A DTV1 52 and the identification information on the controlled-portion being selected of DVD Disc1 53 in two pieces of identification information the RAM1 5 as the control correspondence table 51 (FIG. 23).

[0145] At this moment, suppose that selected information on the controlled-portion for DVD Disc2 55 has already been selected by the company A DTV2 54 of the control device 61. Then, at a time point T14, the control correspondence table 51 (FIG. 23) is preserved in the RAM1 5 of the DVD player 1 of the information device 62.

[0146] Next, in the DTV1 10 of the control device 61, at a time point T8, the control button 42 of the remote controller 41 (FIG. 22) is operated. The resulting signal is transmitted to and interpreted at the user's operation converting section 16 of the DTV1 10 (FIG. 1). Then, the pass-through command C8 corresponding to the resulting signal is issued to the DVD player 1 of the information device 62. As a result, the

pass-through command is transmitted to the interface 9 of the DVD player 1 of the information device 62 via the interface 12 of the DTV1 10 of the control device 61.

[0147] In this case, the playback button 43 is operated for playing back the DVD disc. Then, a play command is issued to the DVD player 1 of the information device 62 among the pass-through command. On this occasion, the pass-through command C8 also has the identification information on the control device 10 itself.

[0148] At a time point T15, the DVD player 1 of the information device 62 having received the pass-through command C8, can get the identification information on the issuer thereof as the company A DTV1 52. Therefore, that DVD player 1, determine DTV1 52 corresponds to the DVD Disc1 53 by referring to the control correspondence table 51 (FIG. 23).

[0149] Accordingly, the DVD player 1 of the information device 62 that the issued the play command C8 is the DVD Disc1 53. Then, it reproduces the DVD software 4 which is stored in the DVD Disc1 53 of the DVD playback deck part1 3.

[0150] An outline of the pass-through command which is applied to the controlled-portion transmission controller of this embodiment will now be described.

[0151] The controlled-portion transmission controller causes the control device to transmit the control request made by the user to the information device via the communication means. The information device which receives this request controls its controlled-portion.

[0152] The pass-through command is an example of the controlled-portion transmission-controller and is prescribed by the AV/C commands (AV/C Panel Sub-unit Model and Command Set). The pass-through command is given, in a unified form to the information device having a plurality of controlled-portions without indicting the destination.

[0153] FIG. 25 is a diagram illustrating a format of the pass-through command.

[0154] The pass-through command is used to suitably transmit the user's operation to the target from the controller. The pass-through command is transferred from the controller regardless of the state of the target.

[0155] In FIG. 25, "PASS THROUGH (7C16)" 71 is an operation code (opcode), and state flag 72 indicates the state of user's operation of the remote controller, as well as an operation ID (operation id) indicating an identification code corresponding to the user's operation, as an operand (operand) "0". An operation data field length 73 indicates the length of the operation data field, as an operand "1". Operation data 74 indicates contents of the operation data, as the operand (operand) "2" and thereafter.

[0156] An outline of the IEEE 1394 serial bus (hereinafter referred to as "the 1394 serial bus") which is applied to the interface of this embodiment will further be described.

[0157] In the 1394 serial bus, the mode of connection has a limitation imposed thereupon. By connecting respective devices like a tree without loop, sixty-three devices at maximum can be connected to a single bus. The port of each device transmits its received data signal continuously to the other ports, with the result that the data signal is propagated through the whole bus.

[0158] The cable is constructed of two pair of differential signal lines TPA, TPB, a power source pair of VG (ground) and VP (power source). By means of two signal lines of the TPA and TPB are performed dynamic configuration of the bus, arbitration for procuring the right to use the bus, and propagation of data signal. To the TPA is always applied a bias voltage, and the TPB determines the presence or absence of the active cable connection by detecting the bias application.

[0159] Next, a description will be given of signals of the physical layer section. The two signal lines of TPA and TPB each take three values of "1", "0", and "Z". The value "Z" represents a state of high impedance in which the signal lines are not driven by any one of their connected ports. From the TPA is transmitted a signal called "a strobe" while from the TPB is transmitted data. On the receiving side, the data and the strobe are exclusive-ORed to obtain a clock signal and the data is read out at a point of transition in the clock signal.

[0160] Each port detects the presence or absence of the bias which the TPA of a connection partner outputs to thereby determine whether a node is connected or disconnected. The node having detected a change in the connected state of port transmits a bus-reset signal for a prescribed period of time to another port connected thereto. The node having received it transmits a bus-reset signal to still another port connected thereto. This is repeated and finally the bus reset signal is transmitted to all connected nodes. Each node having received the bus-reset signal clears its previous form information, and its own node ID, etc. Thereafter, each node itself recognizes whether it is branch node or leaf node. Specifically, it is recognized whether each node connected to the bus is a branch in a state of being connected to a plurality of adjacent nodes, or whether each node is a leaf whose adjacent node is only one in number. Further, a parent-child relationship is determined with regard to each node, and a root node in the tree structure is determined.

[0161] An asynchronous communication is one of the methods for transferring a data packet used in the 1394 interface. This is a unidirectional data packet transfer. The transmitting side expressly specifies a data packet transfer destination address in a packet header and transmits this data to the bus. The data packet propagates up to every node on the bus. The node which corresponds to the transfer

destination address expressly indicated in the packet header receives that data packet, and returns a received result (ack). This series of transfer steps is called "an asynchronous subaction".

[0162] In this connection, in order to start the asynchronous subaction, the bus must be in a state of being idle for a prescribed period of time called "a subaction gap". Also, while the receiving side receives a data packet and returns the ack, the bus is in a state of being idle. This interval is called "an ack gap". Because the ack gap is sufficiently short as compared with the subaction gap, it never happens that other subactions are started.

[0163] Another method for transferring a data packet in the 1394 interface, there is an isochronous communication. The isochronous communication is performed in synchronism with a cycle start packet that is transmitted at prescribed intervals by a cycle master, a piece of which exists on the bus. When receiving the cycle start packet, the node on the transmitting side of the isochronous communication starts arbitration after an isochronous gap passed and transmits an isochronous packet. In case there exists any other transmitting node, arbitration is subsequently started after the isochronous gap passed, and this node transmits the isochronous packet.

[0164] In this case, this isochronous gap is arranged to have a sufficiently short period of time as compared with the subaction gap. Therefore, even if, during this period of time, there is any node that desires to make the asynchronous communication, no transmission can be made because that node cannot detect the subaction gap. In other words, for each cycle, the priority is given to the node that transmits the isochronous packet. The isochronous communication is performed in such a manner that data are broadcast into the bus without specifying the address of data transfer destination unlike in an asynchronous communication. The

isochronous packets each have a channel number of from 0 to 63 allotted thereto. So, the node needs only to receive the isochronous packet of a necessary channel number.

[0165] In the above-described embodiment, only one example is shown, in which a plurality of control devices and a single information device are connected with each other to form a network. The present invention, however, is not limited thereto. The invention can also be applied to a case where a plurality of control devices and a plurality of information devices are connected with each other to form a network. In this case, the control correspondence table which is produced in an information device may be transferred to another information device for use therein.

[0166] In the above-described embodiment, the control correspondence table is used within the information device. However, the present invention is not limited thereto. The control correspondence table may be transferred to one control device and the other control device will indicate that the information device occupied.

[0167] In the above-described embodiment, an example is shown, in which the device-unique information is acquired at the time of initializing the network. However, the present invention is not limited thereto. It may also be arranged as follows. The controlled portion information acquirement may be executed at the time when the information device is selected by the information device selector.

[0168] In the above-described embodiment, the information device selector selects an information device from the information shown in the device GUI in the control device using the remote controller. The present invention, however, is not limited thereto. The selection may be made using the pass-through command.

[0169] In the above-described embodiment, a device is selected using the information device selector in the control

device, calling the controlled portion notification unit. However, the present invention is not limited thereto. The calling of the controlled-portion notification unit may be made using the pass-through command.

[0170] Also, in the above-described embodiment, the IEEE 1394 format is used for the interface. However, the present invention is not limited thereto. The USB (Universal Serial Bus) may be used therefor.

[0171] Also, in the above-described embodiment, digital television receiver is used as the control device. However, the present invention is not limited thereto. A digital video tape recorder, a set top box, or a router may be used so long as it has a similar structure, operation, function and effect.

[0172] Also, in the above-described embodiment, the communication means has the network formed by a wired connection through the IEEE 1394 interface. However, the present invention is not limited thereto. The network may be made from each of a plurality of control devices connected by a wireless connection using a wireless interface. Further, the wireless communication may be such that, using the Bluetooth method, the control request is wirelessly made at a distance of several meters or so from each of a plurality of control devices. Moreover, the wireless communication may be such that, using an infrared ray method, the control request is made from each of a plurality of control devices based on the infrared ray method to thereby form a wireless LAN (Local Area Network). By doing so, the controlled-portion correlated with the relevant control device will be made to operate appropriately.

[0173] In the above-described embodiment, the user employs the control device such as a digital television receiver. However, the present invention is not limited thereto. A portable telephone may be employed therefor.

[0174] The information control method according to the present invention is intended as follows. When the control device selects the controlled-portion which it wants to control using the selector the selected information and identification information of the selected controlled-portion are transmitted to the information device; the information device causes identification information on the selected controlled-portion and identification information on the control device to correspond to each other and preserves both the selected information and the identification information as a control correspondence table; each time the control device selects the controlled-portion, the selection, the transmission, and the preservation are repeatedly performed; and when the information device receives a control request from the control device, the information device controls by referring to the control correspondence table, the controlled-portion corresponding to the identification information on the issuer of the control request. Therefore, according to this information control system, the information device is provided with a structure which can preserve the control correspondence table, with the result that, even if a control command which the control device issues to the information device has therein no destination of the controlled-portion being an object of control, the information device can advantageously refer to the control correspondence table on receipt of control requests from a plurality of control devices. As a result, the information device can, by this referring, advantageously detect the controlled-portion associated with the control device and can determine that the detected portion is what the control device wants to control. Thus, the information device can advantageously make the controlled-portion operate properly.

[0175] Moreover, the information control method according to the present invention uses, as described above, an IEEE

1394 digital interface. Therefore, by referring to the device-unique information used in the IEEE 1394 format, the information device can advantageously detect the controlled-portion which is associated with the relevant control device.

[0176] Furthermore, this information control method according to the present invention uses, as described above, the controlled-portion and the controlled-portion controller which are both based on the use of the pass-through command defined by the AV/C Panel Subunit Model and Command Set. Therefore, by using the pass-through command that is given to the information device in a unified form without affixing addresses to a plurality of controlled-portions, the information device side can decide the controlled-portion and interpret the user's operation. This advantageously allows the control device to control or select the information device.

[0177] In addition, the information control method according to the present invention includes, as described above, the information device which can reproduce software information recorded in the digital versatile disc. Therefore, the information device can advantageously detect, with respect to the reproduction portions of the digital versatile disc being a plurality of controlled-portions, the controlled-portion associated with the relevant control device. On the other hand, the control device can advantageously control or select the information device.

[0178] Also, the information control method according to the present invention uses, as described above, the a wireless interface. Therefore, by making a control request from each of a plurality of control devices, it is advantageously possible to cause the controlled-portion associated with the relevant control device to operate properly.

[0179] Moreover, this information control method according to the present invention uses, as described above, wireless

communication of a Bluetooth method. Therefore, by making a wireless control request from each of a plurality of control devices at a distance of several meters or so, it is advantageously possible to cause the controlled-portion associated with the relevant control device to operate appropriately.

[0180] Furthermore, the information control method according to the present invention uses, as described above, wireless communication of an infrared ray method. Therefore, by making a control request from each of a plurality of control devices using the infrared ray method, it is advantageously possible to cause the controlled portion associated with the relevant control device to operate properly.

[0181] In addition, the information control method according to the present invention includes, as described above, the information device which can reproduce audio/visual information recorded in a hard disc. Therefore, by expansion decoding the audio/visual information recorded in the compression-coded form for reproduction, the information device can advantageously detect, with respect to the reproduction portions of the hard disc regarding the audio/visual information being a plurality of controlled-portions, the controlled-portion associated with the relevant control device. On the other hand, the control device can advantageously control or select the information device.

[0182] Also, the information control method according to the present invention includes, as described above, a digital television receiver capable of receiving digital broadcast. Therefore, by making a control request from each of the digital television receivers being a plurality of control devices, it is advantageously possible to cause the controlled-portion associated with the relevant control device to operate appropriately.

[0183] Moreover, the information processing apparatus according to the present invention comprises: a plurality of controlled-portions which can be controlled by the control device; a transmitter for providing a selector to the control device in order that the control device can select a controlled-portion to control; a receiver for receiving information selected by the selector and identification information of the control device that selected the controlled-portion; preserving unit for preserving the identification information on the selected controlled-portion and the identification information of the control device as a control correspondence table in which both types of information are in correspondence with each other; and a controller in which, each time the control device selects the controlled-portion, the provision of the selector, the reception made by the receiver, and the preservation made by the preserving unit are repeatedly performed, and which, when the receiver receives a control request from the control device, by referring to the control correspondence table which is preserved, controls the controlled-portion which corresponds to the identification information on an issuer of the control request. Therefore, according to this information processing apparatus, the information device has such a structure that preserves the control correspondence table. As a result, even if the control command issued to the information device by the control device contains no information concerning the selected controlled-portion the information device can advantageously refer to the control correspondence table upon receipt of the control requests from a plurality of control devices. As a result, the information device can, advantageously detect the controlled-portion which is associated with that control device and can determine that the controlled-portion is what the control device seeks to control. It is thus advantageously possible to construct the

information device which makes that controlled-portion operate appropriately.

[0184] Furthermore, the information control system according to the present invention includes the following control device and information device. The control device has selector for selecting the controlled-portion and control requester for making a request to control the selected controlled-portion. The information device has: a plurality of controlled-portions which can be controlled by the control device; a transmitter for providing a selector to the control device in order that the control device can select a controlled-portion to control; a receiver for receiving information selected by the selector and identification information on the control device having selected the controlled-portion; preserving unit for preserving the identification information on the controlled-portion which is selected and the identification information on the control device as a control correspondence table in which the both information types are in correspondence with each other; and a controller in which, each time the control device selects the controlled-portion, the provision of the selector, the reception made by the receiver, and the preservation made by the preserving unit are repeatedly performed, and which, when the receiver receives a control request from the control device, by referring to the control correspondence table which is preserved, controls the controlled-portion which corresponds to the identification information on an issuer of the control request. Therefore, the following advantages are brought about. Even if the control command to the information device issued by the control device contains no information concerning the selected controlled-portion, the information device can advantageously refer to the control correspondence table upon receipt of control requests from a plurality of control devices. As a result, the information device can, by

this referring, advantageously detect the controlled-portion which is associated with the relevant control device and can determine the detected controlled-portion is what the control device wants to control. It is thus advantageously possible to construct the system which can properly operate the controlled-portion.

[0185] Having described preferred embodiments of the present invention with reference to the accompanying drawings, it is to be understood that the present invention is not limited to the above-mentioned embodiments and that various changes and modifications can be effected therein by one skilled in the art without departing from the spirit or scope of the present invention as defined in the appended claims.